A TREATISE

ON THE

HOWARD SYSTEM OF VENTILATION.

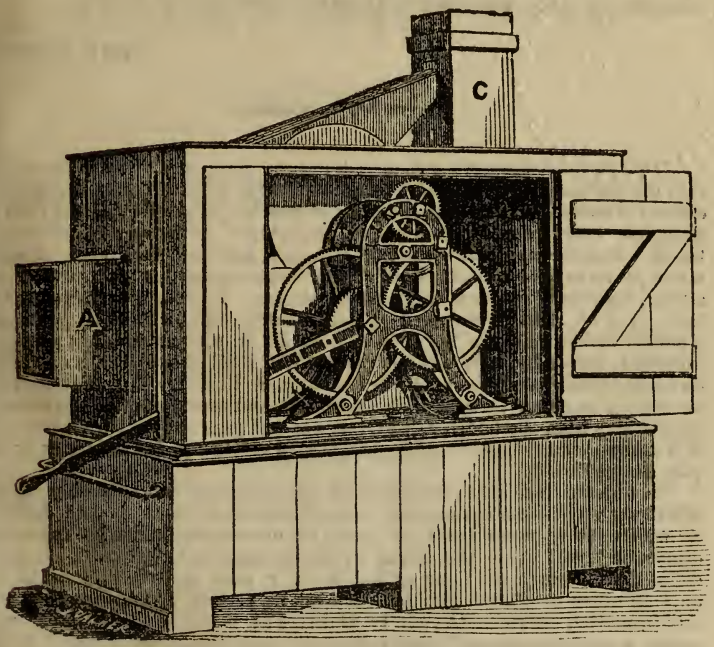
WHEREBY IT IS PROPOSED TO

EXPEL FOUL AIR AS FAST AS GENERATED,

AND

ADMIT PURE AIR AS FAST,

WITHOUT SENSIBLE DRAUGHT ON THE PERSON.



"The Blessed God,s
Purge all infection from our air, whilst you
Do climate here."

—*Shak. Winter's Tale.*

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1871.

DEDICATION.

As a thorough knowledge of the subject of Ventilation concerns the Architects Mechanics and Builders of the Dominion of Canada more than any other class of the people, in that upon them devolves the work of ventilation, this little pamphlet is most respectfully dedicated to them by

THE AUTHOR.

"That the breathing of air rendered impure from any cause is hurtful, and that the highest degree of health is only possible where to other favorable conditions is added that of a proper supply of pure air, might be inferred from physiological evidence of the paramount importance of proper aeration of the blood. Experience strengthens this inference and statistical inquiries on mortality prove beyond a doubt, that of the causes of death which usually are in action, *impurity of the air* is the most important. Indeed, observation confirms this, The air must be removed so immediately that there shall be no risk of a person breathing again his own expired air or that of another person. In hospitals, especially, it is desirable that there shall be no chance of the air of one sick person passing over the bed of another; therefore the movement of the air should be rather vertical than horizontal, and as the expired air and all the exhalations from the body or bed clothes at first pass upwards from their levity it is desirable that they should be discharged above and not drawn down again past the patient."

"In order to keep air in its necessary purity, it must be continually changing. Whatever way the air is supplied, certain conditions must be laid down; the air which enters must itself be pure, its movements must be *imperceptible*, otherwise it will cause the sensation of draught and will chill. It must be diffused all through the room so that in every part movement shall be going on. In other words, the distribution must be perfect. A moving body of air sets in motion all air in its vicinity, it drives air before it, and at the same time causes a partial *vacuum* on either side of its own path, towards which all air in the vicinity flows at angles more or less approaching right angles."—*Parkes.*

PERFECT VENTILATION

EFFECTED BY

Dr. Howard's Patent.

Some time ago I wrote a little pamphlet on the subject of ventilation in which I described an apparatus I had invented for bringing perfectly pure air into a room without draught or chill. Having had for 9 years to keep a very large number of patients in very good health, in a very small space, it was pretty much sheer necessity that forced the invention from me. But this was only one step in my system. And so scientific men and societies, after testifying to the perfection of the instrument, told me —as I well knew—that I had only done half my work—that I should invent a means for expelling foul air as fast as generated, in that no such means, free from objections insuperable, had as yet been elaborated. By a patient course of experiments, I discovered.—firstly, the height at which foul air should be expelled from a building,—secondly, a means for the expulsion without the expensive and cumbersome use of steam, water, horse, or man power. My system is therefore complete and perfected and the present pamphlet gives the whole, where the former contained the half.

It is strange that we are each of us ever emitting from the whole surface of our bodies poison to ourselves and our fellow-creatures. Surround a man with carbonic acid gas and he dies. Yet each adult every day gives off from 12 to 16 cubic feet of this gas from his mouth, besides an indeterminable quantity from his skin.

At the Black Hole, Calcutta, a good many people were merely put into a small room without ventilation. The upshot was gasping horrible

death and a lurid spot in history for ever. Yet many of the authorities of our prisons, court-houses, aye, and of our large schools, are unconsciously playing the part of the Indian tyrant. They only shorten and depress the lives of many in lieu of terminating the existences of a few. What is the cause of the pale faces emerging from our large schools? of the frightful mortality among the children of the rich at Montreal? of the prevalence of suicide in large cities, especially in Paris, where the objection to open windows is notorious? *Imperfect ventilation. It is an established fact that there is more disease and death from the want of pure air than from lack of food or raiment*, or perhaps any other cause. The reason is simple. We all know when we want food and clothes and try to provide them. We do not all know when we are breathing a poisonous atmosphere that will produce disease and eventually death. Statistics show that the death-rate in the different districts in England is proportionate to the density of the population—that is, to the purity of the air. The *length of our lives* then depends upon the purity of the atmosphere in our rooms.

Must we then open our windows? Not with a thermometer often below zero, unless we wish to give death to the consumptive and cold to the healthy by chills and draughts. Shall we leave cracks under our doors? This causes cold feet, and so sends the blood to our heads with the usual unpleasant results. What of admitting heated air through our floors? To heat air, deprives it of the vital principles which make it any good.

What, then, are the general requisites for a perfect system of ventilation?

Luckily on this point Hygeists are agreed:

1st.—The foul air must be removed as fast as generated.

2nd.—Just as much fresh air must be introduced without producing draught or chill.

3rd.—The fresh air thus admitted must be free from carbonic acid gas, sulphuretted hydrogen, dust and vapour.

Take these points in inverse order beginning at the last.

Vapour is often miasmatic causing ague, &c.

Dust if inorganic irritates the system. But Professor Tyndall has shewn that much of the dust of our cities is ORGANIC. In it he found the microscopic germs which breed scarlet fever and small-pox. In it are the impalpable ova of parasites which breed corruption and mortification in open wounds.

In the Howard Ventilator, dust and damp are alike removed by the layer of cotton wool. Note therefore its special adaptation to railway cars; and, as malarious diseases plague and small-pox can be checked by a dry atmosphere, to hospitals and sick rooms.

Sulphuretted hydrogen gas is emitted by our gas-houses. Carbonic acid and sulphuretted hydrogen gas by every man passing beneath our windows. Both are deadly poisons. Both and others like them are absorbed by a layer of charcoal. Sewage air abounds in parts of every city, milk and meat taint rapidly when exposed to it. Charcoal absorbs putrid vapours. The inference is obvious.

The wood cut shows how the Ventilator introduces a constant stream of fresh air without draught or chill.

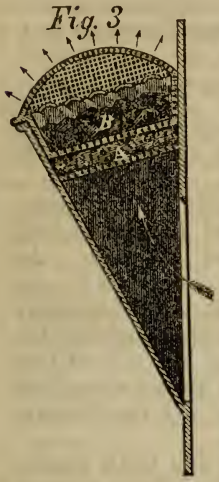

Fig. 3

The chamber A contains a piece of cotton wool resting on and covered by finely perforated plates of metal. Chamber B, similarly made, contains a layer of charcoal. Above all is a convex covering of perforated tin.

Thus the air is a little warmed in its transit, in that the chambers through which it passes are affected by the heat of the room. From the formation of the Ventilator the air passes upwards and inwards, vertically and not horizontally. There can therefore be no sensible draught. It is divided into numerous and continuous streams and is discharged into the room like water from a fine rose on a watering pot. All these descending current-threads in accordance with a well-known law, make the air near them move at right angles nearly, towards their line of motion. Thence there is a constant simultaneous darting of air particles about the room in all directions—one great desideratum. There is a ready proof of the law just affirmed. Beside the flame of a candle place a card. Blow along it on the side away from the candle. The tip of the flame will bend inwards towards, and at right angles to the line of motion of your breath.

We will now explain the rationale of the movements of air in a room.

Carbonic acid gas is heavier than ordinary atmospheric air. Hence theorists have assumed that when exhaled from our bodies it will fall to the floor of a room. But it is not so. "The breath of man" is warmed by the combustion in his body, is thus rendered much lighter than air from without, and rises towards the ceiling. The cold air falls and takes its place; the coldest and heaviest and purest being next the floor. Those who escaped from the Black Hole of Calcutta, had lain with their faces close to the ground. Let your head touch the ceiling of an occupied room and nose and nausea alike show where the foul air is. Ask any plasterer. Blow soap-bubbles, your breath will not only ascend but carry a fair amount of soap and water on its back. As none deny that ordinary heated air ascends, the plan of introducing hot air into the top of a room and forcing it out from the bottom is alone paralleled by Gulliver's friends who succeeded in making water run up hill.

The way then in which the Howard Ventilator acts, is as follows:—The cold air rises through it into the room, impinges on the ceiling just above it, descends transversely by the force of its own weight and (just as the Polar current floats up the Gulf stream), floats up the lighter rarified carbonic acid gas that has just left our mouths. It is warmed a little in its transit through this, but does not mix with it. How is all this known? By actual observation. Natural phenomena, curiously enough, seem always to contradict our preconceived notions. There

is one way alone of knowing how the forces of nature act. By actual observation.

The following extracts from a letter already published in the Montreal press, clearly demonstrate how gasses arrange themselves in a room.

Experiments in the men's Dormitory of the St. Johns Lunatic Asylum.

"This room is about 40 feet square and 10 feet high and contains 37 beds. Near its centre are a small coal stove and an upright post, 12 feet apart.

Feb. 2nd, 1870,—at 7 p. m., I arranged on the post 3 thermometers 3 feet apart, and also 10 tumblers of lime-water and 10 slips of lead paper 1 foot apart. I then closed the ventilators and exit shafts. At midnight the lowest thermometer was at 56°, the next 62°, the highest 68°. The outside air was at 27° above zero. All the tumblers of lime-water were discolored, but the higher they were the greater the whiteness *up to 9 feet*. Those at 7, 8 and 9 feet high had a crust that could be removed by the finger. But that at 10 feet was not worse than that at 3 feet. So with the lead papers. Up to 9 feet only the discoloration increased.

The next night the same arrangements were made only the 6 ventilators and outlet shaft (area 2 feet) were open. There being no wind I could use Montgolfier's form and estimated that there was admitted to the room 61,800 cubic feet of air per hour. At 7 p. m., the thermometers ranged thus: That outside the room, 11° above zero; those inside, 56, 63° and 70°. At midnight; outer air, 8° above zero; in the room, 58°, 62° and 62°. At 7 a. m., on the 4th; outer air, 4° below zero; in the room, 58°, 62° and 62°. The lime-water and lead papers were left up all night. In the morning the lime-water under 7feet was not at all discoloured and very slightly above. So with the lead papers. The tumbler and lead paper at 10 feet were not affected at all."

These experiments show:

1st. That the passage of 61,800 cubic feet of air per hour through the Ventilators, with the outer air below zero, did not render the room sensibly cold.

2nd. That the pure air though admitted at a height of 8 feet was to be found nearest the ground.

3rd. Observe most particularly, that whatever impure air was in the room was between 7 and 9 feet from the ground.

So far then as the Ventilators are concerned, 6 for 37 persons kept a room sufficiently pure where each patient had not more than one-third the air-space usually held requisite. They do therefore, all that scientific men and societies who have testified to their merits claim for them and need be discussed no further. There are indeed those who will not believe that air comes into a room, unless they feel the wind blowing upon them, although told that what they ought to have is air without draught. With such it is useless to argue.

But the most important part remains, viz.: The first and foremost of the three laws laid down by hygeists.

"That foul air must be expelled as fast as generated," or, in other words, "that the air must be removed so immediately that there shall be no risk of a person breathing again his own expired air or anothers.

To effect this, the foul air must be carried off vertically, and there must be an exit shaft.

The third conclusion from the experiments above detailed, shows a most important fact. It is that the mouths of the exit shafts must be between 7 and 9 feet from the floor. This when once discovered by observation seems, amusingly enough, almost self-evident. Parkes shows that we not only give off gasses from our bodies, but also particles of organised and disorganized matter. It is only natural that these should be carried by the rising breath a little way above our heads and no farther. Again, the gas which leaves our bodies hot would cool in its ascent to any great height, and so become heavy and descend, to be again breathed. It is almost laughable to see, when we have once found out a thing, how easily it seems we might have guessed it before.

We now see why an open fire-place is not sufficient for ventilation. Firstly, a fire burns oxygen, and so takes more pure air than foul from the room. Secondly, a fire-place by force of its position would draw the exhaled poison down past our nostrils before removing it.

What then of a mere exit shaft? Such shafts act often as much as inlets as they do as outlets. When the outer air is not positively colder than the air inside a room, the inside foul air is heavier and does not ascend and so in the most oppressive weather the shaft is useless. Again 'posit' [as logicians say] the case of an assembly with but 500 people in it. Parkes determines the inlet and outlet area we require per head to be one-third of a square foot. Then 500 folk will require an opening of 166 square feet! A sufficiently comic *reductio ad absurdum*. We shall have to fall back on the roofless Parthena of the Greeks, and compose ourselves at the "Public Show" with expanded umbrellas, as at Braintree Church while the famous church-rate case was pending. But suppose we give up science in despair and fall back on common sense [often a mere euphenmism for uncommon nonsense,] and have outlets large enough to satisfy our consciences, and so hidden as not to raise the alarms of age—what then? Age would be justly alarmed—the exit area, being large, half acts as outlet, half as inlet—the temperature of the room approximates to that of the outer air, and there is little ventilation and no heat. 'Posit,' any public meeting, the desideratum is an exhausting apparatus to withdraw foul air only, for of noxious gas *per se* we do not generate more than 2 or 3 cubic feet an hour. As things now are, how peculiarly unfortunate is the case of the hapless attendants at such gatherings in our worse than tropical summer! Then, the outer atmosphere is of equal heat, and so in equilibrium with, that in the room. The shafts are therefore, still and stagnant; and all this is going on unperceived when and where exudation and exhalation are especially copious and noxious. Here at any rate an exhausting apparatus is imperatively demanded.

In hospitals, each patient requires from 3,000 to 6,000 cubic feet of pure air per hour. Mere air shafts here are manifestly insufficient and

if they open low down [as they have actually been made to do] the air rising from one patient descends past another to the peril and jeopardy of all.

In the holds of ships and in wells the foul gasses are cold and heavy, remain on the bottom and cannot ascend till nature changes her laws or art comes in. Obviously the only thing that can here avail is a hose connected with an exhausting apparatus.

And so men of science after testifying to the perfection of the Ventilator so far as it went told the inventor his invention was "one-legged," his work was only half done. This he very well knew. The expulston of the foul air was after all the great thing.

To have discovered the height at which foul air should be withdrawn from a building was one main point. It remained to review the different apparatus previously in use for expulsion.

Firstly. All those which depend on wind as a motive power, are insufficient. It is precisely when there is no wind that it is most needed. Moreover, the wind sometimes forces the air down instead of up, as when rain gets in, and by evaporation so cools the air that it becomes heavier than the air in the room; or when another outlet shaft with a great discharge reverses the current.

Another device is to have a large chimney with a fire at the bottom and by a complication of tubes to run the outlet shafts from the different rooms into the bottom of the chimney close to the fire. But this works against Nature by pumping hot air down. Every curve in the tubes adds to the work. Every right angle multiplies it and obviously the expense of erection and of keeping the fire constantly burning is enormous.

If hot air be introduced into the bottom of the rooms, it will by its own levity move out of shafts in their ceiling. But hot air is devitalised air and what we want is the breath of life. The blood in the lungs is sufficiently warm and to heat it still further, causes the suffocating feeling we know so well on entering a house warmed by hot air. Part of the miserable state of health of the richer inhabitants of the United States is no doubt owing to their general use of hot-air furnaces. Houses fitted up with these, demand more than all others an exit shaft with a powerful current, such as that produced by the chimney and fire mentioned above or the Howard Foul Air Expeller. By means of either of these, they would ensure a flood of warm air which is life, instead of a rivulet of hot air which is suffocation.

All that remains is the fan.

Its simplicity, the certainty of its action unaffected by wind or storm, the immense amount of air moved with very slight power, its perfect submission to the will and wish at once strongly recommend it. And in fact it has been in use for impulsion for more than 100 years. In one case at the Hospital Lariboisiere, at Paris, it was kept in use although (as perhaps it is less fitted for impulsion than expulsion) it was found that nature by differences of temperature did for nothing no less than 17–20ths of the work, the fan at great cost was erected to perform. The great objection to the use of the fan has been the cumbersome and expensive arrangements necessary to keep it in motion, by steam, water,

horse, or man power. That has been happily overcome by the application of clock work in which 5 minutes labour will make the fan go for 12 hours.

The fan will expel foul air alone for the opening in the shafts leading to it is exactly where we find the foul air in an occupied room to be, viz : from 7 to 9 feet from the ground.

Now, most people know that if we remove air from a room, fresh air WILL force its way in to fill up the " abhorred vacuum." There is a pressure of 14 lbs to the square inch that is the weight of a column of air 5 miles high—to push it. But observe that the inlet area ought to be made equal or nearly equal to the outlet area. Otherwise, air will rush in through small openings at a great velocity. Warm air in rapid motion—even the Hot Wind of the desert—chills. But such draughts as these have the peculiar quality of passing through a warmer medium unchanged in intensity of cold. This is especially the case with draughts running up the flues of fire-places, and stoves which tend to suck the air-currents in low down and generally under the doors, and these rush to the flue without mixing. This is actually going on in an absolute majority of our sitting-rooms. The fresh air chills our tenderest extremities—the feet—and passes up the chimney. The foul air remains in the room. Remember therefore, always to put your stove as close as possible to the most exposed and loose-fitting door in your house.

The vent at 9 feet high-heading leading to an expulsion fan will draw out the polluted air, when from its very heat and moisture it was ready to expel itself and by simply making inlets, fresh air will rush in. By this plan we govern Nature—as Bacon says—by obeying her. We make her help us do our work. Only let your openings be above your head. To have a slit cut out at the top of one of the highest lights of glass—or before it is put in to have the pane cut too short for the glass, is simple, efficient, and invisible. Or some simple contrivance may be used to break the force of the wind. A double pane of glass, the outer with a vacancy at the bottom, the inner at the top is sufficient. Triangular boxes closed at the sides and open above, are an approach to the scientifically correct shape of the Ventilator, and do fairly well. Or the window sashes might be made to slope inwards when they open with a pivot and cord. This plan has lately been introduced into many of the churches of Montreal. The objection is that, when the inlet is an unprotected gap than *can* be closed, it *will* be closed by somebody at the first imaginary chill. " Stuff up that hole," was our first cry on entering our school dormitories. " The hole" in question was a brick left out in the wall close to the floor. If you do not want your fuel to chill instead of warming you, pray avoid all cracks and crevices, much more holes, below the level of the stove—unless indeed it be a vent, opening right under the stove and connected by a pipe with the outer air. A friend of mine slept one winter with a window open at the top and felt no cold. This was in a house plastered outside and in. Nothing arrests wind like plaster. The next winter in a frame building,—*i. e.* in one where air came in at low levels, a sponge froze nine inches from a stove-pipe communicating with a burning fire below.

If it would require too many Ventilators to provide sufficient inlet area —if your

"Climate's delicate, the air most sweet,"

if you live where "the heavens' breath smells wooingly" and "the air nimbly and sweetly recommends itself unto your gentler senses"—then use your air unpurified. Buy a Howard's Ventilator without the charcoal box, have mere openings to admit it, but at any rate see that the foul air is expelled wherever you are. See to this especially in halls for public meetings. Had man but "the microscopic eye," could he but espy what filthy gasses, aye, what organised matter "that well might poison poison," he breathes in crowded assemblies where there is no ventilation "urgent private affairs" would more often keep him at home.

It is not propounded that the exhauster is absolutely neeessary for private houses, though in summer it would be as great a luxury as the windfunnels in Egypt and at all times a great advantage. But it *is* maintained that something of the sort should be demanded for every sleeping car on our railroads, for schools, churches, court-houses, prisons, asylums, passenger vessels and all hospitals. In the New York city hospital, one ward had actually to be pulled down brick by brick and rebuilt with fresh materials to check hospital gangrene which takes no hold with efficient Ventilation! This comically expensive result of inadvertence suggests the complaint of a fellow-physician in the old country, that he had lost £40 a year by one prescription. "In that house" said he "lives a rich quaker. He has all his servants doctored like himself. I send them the most palatable, expensive mixtures. His yearly bill used to be about £50. Last year it was 7 pounds and 15 shillings. One day noticing how warm and cosy and close the house was, I prescribed—— 'Ventilators for every window'—I'll never do so again."

This is no fable.

No building is so perfect but that as Shakespeare says "where air comes out, air comes in." But we repeat to have a great quantity darting in through chinks and crannics low down causes draughts. Draughts cause chill, disease and death. To check this, sufficient inlet area must be provided above the head. To have the inlet and outlet opening so nearly of the same height, would seem a paradox. But nature appears to delight in such paradoxes. One motto of a discoverer might be if not "credo quia incredibile," at any rate "credo quia inexpectabile." It worked unexceptionally well in McKinnell's double-circular-tube, the only flaw in which is, that it depends on the wind which is often still and contrary when most needed. Often as Solomon says, Nature seems to try to conceal a thing and it is an especial glory to a man to search it out.

It is astonishing what an amount of cold wind and exposure [but not draught] strong healthy people who ensue exercise and cold water will stand. Young kingsleians, wear flannel, open your windows and endure "perflation" [as you probably endured tobacco] till you like it. A friend at college used to write and study with his hat on and weights on his papers and certainly his fresh looks belied his consumptive constitution,

But no one has any right to kill the delicate with the prevalent rough and ready Ventilatoin or to benefit Life Assurance Companies at the expense of the general public, by the still more prevalent—no ventilation at all.

TO VENTILATE A BUILDING.

The Exhauster being placed in the loft or other convenient part of the building, tubes A and B in the figure on the title-page must each be connected, either with a main-shaft 1 foot square, air-tight, made of well-seasoned dressed plank, or with a large air-tight box. Into the main-shaft or box whichever is most adapted to each special case, run vertical shafts with mouths or openings (which may be covered with some tasty grating) about 9 feet from the floor of the different rooms. The outer casing of pendant gaseliers, &c., may be used for such vertical shafts.

Tube C must then run into a chimney, or into a shaft, or straight up through the roof of the house. If the latter, cover it with a cowl to exclude snow and rain.

Care must be taken to avoid right angles both in joining the vertical shafts with tubes A and B, and in the vertical shafts themselves. The joints and changes of direction must be curved or at a right angle.

Should shafts A and B be not required at the some time, one can be stopped working by turning the key in it, and the power economised for the other. The weight can be placed in the cellar of the house if the loft be not high enough to allow sufficient drop. The rope to which the weight is attached must then pass over a roller in the loft and run down a small shaft or pipe in or along one of the walls of the builbing. But if the loft be not less than 15 feet high in its highest part, a roller must be there placed, the rope passed over it and the weight attached to the rope. For every hour the machine is required to run without being wound up, there must be 10 inches drop for the weight whose movements must be protected by a case as the weights of a clock are.

The winding must cease when the bell sounds.

The works must be oiled every other day with machine oil. Especial care must be taken to put one drop of oil three times a week into the bush or journal-box of the fan. In front a hole will be seen in the bush to receive the oil. Behind, a tube will be seen protruding from the fan box to conduct the oil to the other bush.

The machine will expel 75.6 cubic feet of air per minute or about 4,500 every hour. It will accordingly entirely change the air in a building 90 feet long by 60 feet wide by 20 feet high once every 24 hours. If the exit shafts open 9 feet from the ground of the occupied rooms the machine will expel 54,400 feet of foul air only as fast as generated, which is sufficient to contaminate 12 times that amount—*i. e.* 652,800 cubic feet of pure air, and it will do this in 12 hours or at one winding up of the machine.

To enlarge the outer casing of the gaseliers sufficiently for them to act as vertical shafts might be made to add to their massive and handsome appearance. Their position in an assembly room or in most public buildings would bring them under a long central or X shaped shaft in the loft. Now in a gas-burner we seem at last to have found the veritable upas

tree. One alone is competent to empoison 10,000 feet of pure air in an evening, but observe only, as Parkes says, if the products of combustion are not removed by a special channel. In public buildings then, which are used mainly at night, the main shaft in the loft must be made 2 feet by 1 instead of one foot square, and divided longitudinally into two distinct compartments. Into one of these must run the air passing up between the two casings of the chandeliers which must be conducted to tube A and B. Into the other, openings must be made above the jets to carry off the products of combustion and this second compartment must communicate with tube C *above the fan.* The burnt air from the gas jets being extremely hot and therefore extremely light, will of itself pass rapidly into tube C and out of the chimney or the cowl in the roof and not retard the action of the fan.

If tubes A and B be connected with a box and not with a main shaft the air from the gas-jets or the uppermost vertical shafts, [whose openings should in this case be higher than the others] must be converged into tube C above the fan. The fan will maintain a constant upward current of air and thus help to expel infinitely more air than passes between its blades.

It may be objected that the machine expels hot air and so makes fuel come more expensive. It does. Have a room entirely without ventilation and your fuel will cost you nothing. But, as the Austrian prisoners found at Austerlitz, man could not live in such a room, and even a candle will first burn with a sickly flame and lastly flicker out. There are two kinds of hot air; the one given off by the lungs, or a burning light which is poison; the other warmed by a stove or fire, which is life. From the position of the mouths of the exit shafts it will be seen that the machine expels the former and not the latter.

Let your house be but a frame building, plastered inside and out, and then cased in with the thinnest of brick or groat walls and you can combine an expeller with a very small bill for fuel.

Assuming that the Expeller is at work expelling foul air as fast as generated, the next thing is to provide equal inlet area for pure air. Now, as no place in a city can be said to be a source for pure air, in cities certainly the

HOWARD PATENT VENTILATOR

Must be used to strain and purify all that comes in.

DIRECTIONS FOR USE.

The Ventilator must simply take the place of a pane of glass in the top of a window. In erecting a house, the builder can place it in the wall 8 or 9 feet above the inside floor. It may very conveniently be placed over a hall or back door where there is a light. In railway cars, the outlets for foul air must be below the Ventilator. In them the cotton wool is especially needed to exclude steam and dust. Elsewhere it may generally be dispensed with.

The boxes must be taken out and dusted occasionally, and the Ventilator not placed where this cannot be done conveniently.

One Ventilator is enough for every 12 persons in a room; at night one for 8.

In ordering, give the exact size of the space the Ventilator is required to fill.

If any Architect, Mechanic, or Builder, who takes contracts for the ventilation of buildings on the Howard principle, wishes for any information not contained in this pamphlet, Dr. Howard will be most happy to supply it, on application, to the full extent of his power.

Application for Expellers and Ventillators is to be made to L. H. Marchand, Esq., St. Johns, P. Q., who is prepared to contract for the ventilation of buildings, and for public convenience will pay a visit once every month in Montreal.

In conclusion, I beg most heartily to thank the Hon. Louis Archambault, Commissioner of Public Works for the Province of Quebec, for the opportunity afforded me by him of proving the excellence of my system of ventilation in the Court House at Montreal.

CAUTION.—Any person found using one of Howard's Expellers or Ventilators, without the Patent Stamp being on it, will be prosecuted with the full rigour of the law.

The prices can be learned on application to L. H. Marchand, St. Johns.